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SPEECH CONTROLLED DISPENSING OR COLLECTING DEVICE

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BACKGROUND OF THE INVENTION

1. Field of the Invention

The invention relates to methods and apparatus for dispensing items and maintaining an inventory of the items dispensed. More particularly, the invention relates to a voice-activated dispensing system for receiving verbal identification of the type and quantity of items to be dispensed.

In large medical facilities, inventories of medical supplies are held in storage locations which are often far removed from the patients who use them. To facilitate delivery of the medical supplies from the storage area to the patient, a variety of dispensing systems have been proposed. In one such system, referred to as a "cart exchange" system, dispensing carts are distributed at remote dispensing stations in the medical facility and are periodically exchanged with fully supplied carts. The "used" cart is returned to a central supply area where inventory decreases of particular medical supplies are recorded and the cart is restocked to predetermined "par" levels. These par levels are intended to ensure constant availability of required medical supplies.

In a similar system, individual carts are used but are not removed from their remote locations in the medical facility. Instead, a larger cart holding a variety of medical supplies is circulated throughout the facility to restock individual carts to their par levels.

Although these systems are generally effective in providing medical supplies to remote locations away from the storage area, they suffer from a number of drawbacks. One particular drawback is the potential for "stock-outs" that can arise if the inventories of the carts are not closely monitored. Adequate inventory monitoring can be problematic due to time limitations on the hospital staff. Depletion of

certain items from the carts can pose serious risks to the patients in the medical facility.

To ensure that sufficient supplies are maintained in the carts, overstocking can occur which in turn increases the cost of the medical facility's inventory system by requiring more items to be maintained in inventory than are actually required. Excessive restocking is also demanding on the hospital staff who must devote more of their time to monitoring the carts to ensure that sufficient supplies are available.

Another drawback of the above-described inventory systems is the lack of security provided for the supplies maintained on the carts. Since access to the items can usually be gained without recording patient and/or user identification information, medical personnel may neglect or forget to record removal of the accessed supplies which can introduce errors or inefficiencies into the medical facility's inventory system. Lack of accountability can also discourage the return of unused supplies. Without a record of user access and removal, medical personnel may often choose to discard the supplies rather than taking the time to return them.

In yet another drawback, no direct data transfer from the supply carts to the hospital inventory and billing systems is provided. This can lead to further inefficiencies in the inventory system.

One proposed system intended to focus on such problems is a "see and touch" type of dispensing unit as described generally in U.S. Patent Applications Serial Nos. 08/095,619, filed July 21, 1993 (Attorney Docket No. 16166-1); 08/250,223, filed May 27, 1994 (Attorney Docket No. 16166-1-1); and 08/274,926, filed July 14, 1994 (Attorney Docket No. 16166-3), the disclosures of which are herein incorporated by reference. Such a system allows a user to visually locate an item to be removed and to record removal of the item by pressing a touch-sensitive button in close proximity to the storage location of the item. A similar procedure is used when placing items into the unit. Once the button is

selected, access is allowed to the items. This system has proven to be a successful and convenient alternative in providing security to the items held in the unit while maintaining an accurate inventory of the items. Despite the success of such a system, it would be desirable to make the system more versatile and to offer additional and alternative methods for inputting transfer information without reducing its security features.

An emerging technology useful in enhancing communication between individuals and machines or computers is voice-activation or voice-recognition technology. Such technology provides machines or computers with the capacity to produce verbal recitations. A user is able to respond to these recitations by speaking into a receiver on the machine or computer. The verbal response is converted into electronic form for further use or processing by the computer.

Although voice-recognition technology has some promising aspects, it suffers from a number of drawbacks. Perhaps the greatest is that only a small vocabulary of words can be understood and processed which limits its potential use.

It would therefore be desirable to provide a dispensing system that could successfully integrate the use of voice-recognition technology to dispense the items and to maintain an accurate inventory of the items. Such a system should be able to dispense a large variety of items from a variety of locations on the dispensing unit. Further, the system should be easy to use while still providing security to items held in the dispensing unit.

2. Description of the Background Art

U.S. Patent No. 5,263,596 describes a subassembly for use in a medical dispenser station which dispenses pharmaceutical items in single quantities from a locked storage location.

U.S. Patent No. 3,715,148 describes a medicine dispensing cabinet having a plurality of sliding drawers and a plurality of dispensing trays.

U.S. Patent No. 3,556,342 describes a medicine dispensing apparatus for dispensing medicines from a cabinet and into a hopper.

5 U.S. Patent No. 5,047,948 describes a medication dispensing system for dispensing medicines into a receptacle in the bottom of a medicine cabinet.

U.S. Patent No. 4,962,491 describes a portable medication dispenser for visually and audibly indicating the times at which a patient's medications are to be taken.

10 U.S. Patent No. 5,014,875 describes a medication dispenser having a housing with a plurality of locked drawers which are stocked with selected pharmaceutical items. Access to the items is allowed upon keyboard entry of a predetermined access code.

15 U.S. Patent No. 3,917,045 describes a drug dispensing apparatus for automatically dispensing one or more individual drug doses to a common collection area as required by a patient.

20 U.S. Patent No. 4,019,793 describes a pharmaceutical dosage distribution apparatus having an enclosure with a door and a plurality of trays.

U.S. Patent No. 4,267,942 describes a pharmaceutical storage and dispensing cabinet for dispensing items into a retrieval tray for removal.

25 U.S. Patent No. 4,360,125 describes a medication dispenser which can provide a medication alert signal in accordance with a desired medication regimen.

30 U.S. Patent No. 4,473,884 describes a portable medical dispensing unit for storing pills. The dispensing unit is programmed with a medication schedule which causes visual and audio signals when it is time for medication to be consumed.

35 U.S. Patent No. 4,635,053 describes an apparatus for monitoring and restricting access to individual items which are provided with a unique identifying code. The codes are scanned by a microprocessor to identify removal of the item.

U.S. Patent No. 4,695,954 describes a system and method for dispensing medications prescribed by a doctor. The

system includes a medical dispenser which can read prescription information from a memory device and make the medications available to the patient at the prescribed times.

U.S. Patent No. 4,785,969 describes a medication dispensing system for controlled programmed dispensing of medication to a patient and for creating a retrievable patient medication record.

U.S. Patent No. 4,811,764 describes a medication dispenser station having rotatable carousels with vertically open compartments containing individual doses of a medication.

U.S. Patent No. 4,847,764 describes a system for dispensing medications in a health care institution.

U.S. Patent No. 4,942,275 describes a control panel face for mounting to a control member.

U.S. Patent No. 4,967,928 describes a medication cart for dispensing medicines during a nurse's rounds.

U.S. Patent No. 5,055,660 describes a transaction monitoring and security system for recording data from the sale of articles.

U.S. Patent No. 5,069,511 describes a pharmaceutical cart for retaining a plurality of dispensing bins on shelves.

U.S. Patent No. 5,259,668 describes a medication cart having a base formed of a pair of molded plates interconnected by rails. The plates have molded grooves and holes for receiving structural elements of the cart.

U.S. Patent No. 5,267,174 describes a medication delivery device having a housing containing separate storage locations for holding medication dosages away from access by the user.

U.S. Patent No. 4,641,342 describes an input system for a voice recognizer circuit wherein a cue signal is issued to the user to indicate system readiness.

U.S. Patent No. 4,882,475 describes a system for a pizza home delivery service and includes a voice synthesizer unit to remind the driver that the order includes beverages or more than one pizza container, or when cash payments exceed a predetermined amount.

U.S. Patent No. 4,961,533 describes an apparatus for a bar which automatically determines the weight of a plurality of articles. The apparatus includes input means that could include a voice-actuated transducer.

5 U.S. Patent No. 5,036,538 describes an electronic voice recognition system utilizing a microphone having noise-cancelling characteristics and a standardizer network to achieve further noise reduction and signal standardization over a range of input levels.

10 SUMMARY OF THE INVENTION

The invention provides a method for recording inventory information related to addition and removal of items to or from a target storage location. The target storage location is disposed in an enclosure having a plurality of storage locations each of which has at least one positional coordinate which is visually apparent. According to the method, the target storage location in the enclosure is visually located and its positional coordinate is determined. 15 The positional coordinate associated with the target storage location is then verbally recited, and the recitation is translated into an electronic record. A desired item is transferred to or from the target storage location, either before, during or after recitation of the coordinate. 20 Preferably, the positional coordinate is recited into a receiver on the enclosure. The receiver in turn is in communication with a processor which records the transfer. 25

In a particular aspect, an audible message is produced which confirms the electronic record. The audible message can be a prerecorded message stored in the processor which recites the positional coordinate selected. 30 Alternatively, the audible message can be produced from the processor itself based on code stored in the processor, i.e. by a text-to-speech conversion. The processor uses the code to directly covert the electronic record into the audible message confirming the selected location. In another particular aspect, a visual signal is produced on the enclosure near the target storage location in response to the 35

verbally recited positional coordinate. Production of the visual signal assists the user in locating the desired item. In a further aspect, the name of the item to be transferred is verbally recited and is compared to the positional coordinate to confirm that the positional coordinate was correct.

In an exemplary aspect, a second positional coordinate associated with the target location is determined and verbally recited. Such a coordinate is helpful when the unit includes a two dimensional array of storage locations. The two coordinates are used to uniquely define an address for the storage locations in the array.

In a particular preferable aspect, a running total of items held in the storage locations is produced. The running total is updated based at least in part on the electronic record. In this way, the processor is able to determine an up-to-date inventory of items held in each of the storage locations after each transfer. In still another aspect, a verbal recitation is given as to whether the item to be transferred is to be taken or returned prior to transferring the item. This information is then used by the processor in determining the running total.

In another aspect, an audible message is produced to instruct the user on how to transfer items to or from the enclosure. In this way, the audible message can serve as a voice prompt to instruct the user on how to make and record a transaction.

In one particular aspect, both patient and user identification information are provided to the processor prior to transferring the desired item. Access to the enclosure can then be denied until both the patient and user identification information have been entered into the processor. Alternatively, access to the enclosure can be prevented until the positional coordinate has been verbally recited to the receiver.

In another aspect, the voice of the user spoken into the receiver is compared with a voice sample of the user. If the voice of the user differs from the voice sample, access will be denied. This provides security to the items by

ensuring that only authorized personnel will be afforded access to the items.

In yet another aspect, the quantity of items to be transferred is verbally recited into the receiver. An audible message can then be produced which confirms the quantity selected.

The invention further provides a method for maintaining a supply of items on a dispensing unit that includes a plurality of storage locations, each of which has at least one positional coordinate which is visually apparent. According to the method, target storage locations having the items to be removed are visually located. The positional coordinates of the target storage locations are then determined and verbally recited. The verbally recited positional coordinates are then translated into an electronic record and the items are removed from the target storage locations. Periodically, items are placed in the storage locations to replenish the supply of items. The periodic placement is recorded and is used to update a running total of items held in the unit.

In a particular aspect of the method, an audible message is produced which confirms placement of the quantity of items placed in the storage locations. This helps to insure that the quantity recorded conforms to the actual number of items restocked.

In another aspect, a running total of items held in the storage locations is produced based at least in part on the electronic record. To assist in maintaining an accurate running total, an audible inquiry is produced that requests entry of the actual number of items held in one of the storage locations. This entry is then compared to the running total.

The invention provides still another method for transferring items to or from a dispensing unit that has an enclosure with an interior for holding items. According to this method, a desired item is visually located in the enclosure. Information identifying the item to be transferred is then verbally recited and is translated into an electronic signal. The item is transferred to or from the enclosure, and

the signal is recorded to produce a running total of items present in the enclosure. Preferably, the running total is produced by adding or subtracting the recorded signal to or from a record containing the total number of items in the enclosure.

The invention provides an improved method for recording inventory information related to addition and removal of items to or from a target storage location in an enclosure. The enclosure includes a plurality of storage locations and an associated processor for storing electronic information as to the type and quantity of items in the enclosure. The improvement comprises verbally providing information as to type and quantity of items to the processor as the items are transferred.

In a particular aspect, the verbal information is translated into an electronic signal, and the signal is recorded in the processor to produce a running total of items present in the enclosure. Preferably, the running total is produced by adding or subtracting the recorded signal to or from the electronic information.

The invention provides a dispensing unit having an enclosure having an interior for holding items, a receiver for receiving verbal recitations identifying items to be transferred to or from the enclosure, and a processor in communication with the receiver. The processor is configured to interpret the verbal recitations from the receiver and to maintain records on items dispensed to individual patients and on the total number of items in the enclosure. Preferably, the enclosure includes a plurality of storage locations, and the processor is configured to maintain records according to each location.

In a particular aspect, the processor interprets verbally recited positional coordinates relating to each storage location. Preferably, each storage location has at least two positional coordinates and the processor is configured to interpret the two coordinates when the coordinates are successively recited. In this way, at least some of the storage locations can be provided with shelves

having bins so that the first coordinate defines the shelf and the second coordinate defines the bin on that shelf.

Alternatively, at least some of the storage locations can be provided with drawers having receptacles so that the first coordinate defines the drawer and the second coordinate defines the receptacle.

In still another aspect, the enclosure includes a door for allowing access into the interior of the enclosure and means for locking the door to prevent access to the interior. In this way, the door can be unlocked by a signal sent from the processor after user and patient identification information have been entered into the processor and one of the positional coordinates has been spoken into the receiver. In a further aspect, the door remains locked until the quantity of the item to be transferred has been spoken into the receiver.

In still another aspect, means for determining whether user identification information corresponds to the voice of the user is provided. In yet another aspect, means for audibly confirming the transfer of an item is provided.

In another aspect, a speaker is in communication with the processor, and the processor is configured to send a signal to the speaker to produce an audible message reciting how to record transfers of items to or from the enclosure. In this way, the audible message can serve as a voice prompt to instruct the user on how to make and record a transaction.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 illustrates a dispensing unit having a receiver for receiving verbal recitations and a processor for interpreting the verbal recitations and maintaining a record of items held in the unit according to the present invention.

Fig. 2 is a more detailed view of shelves in the dispensing unit of Fig. 1.

Fig. 3 is an alternative embodiment of the interior of the dispensing unit of Fig. 1 showing the use of a drawer having a plurality of bins.

Fig. 4 is a flow chart showing an exemplary method for transferring items to or from a dispensing unit according to the present invention.

Fig. 5 is a flow chart illustrating an exemplary method for restocking items in a dispensing unit employing a voice activation inventory system according to the present invention.

DETAILED DESCRIPTION OF THE SPECIFIC EMBODIMENTS

The invention provides improved methods and apparatus for transferring items to or from a dispensing unit and for maintaining an inventory of the items. The methods and apparatus of the invention are improvements over the dispensing units as described generally in copending U.S. Patent Applications Serial Nos. 08/095,619, filed July 21, 1993 (Attorney Docket No. 16166-1); 08/250,223, filed May 27, 1994 (Attorney Docket No. 16166-1-1); and 08/274,926, filed July 14, 1994 (Attorney Docket No. 16166-3), the disclosures of which have previously been incorporated by reference. Briefly, the dispensing units described in these applications have a "see and touch" feature which allows a user to visually locate an item to be removed and to record removal of the item by pressing a touch-sensitive button in close proximity to the storage location of the item. A similar procedure is used when placing items into the unit.

This invention improves upon such dispensing units by allowing information relating to the transfer of items to or from the dispensing unit to be verbally entered into the dispensing unit. Such a dispensing unit allows the eyes of a user to be focused on the item or items to be removed without having to continually refer to a display screen to receive instructions from the unit. The dispensing unit further frees the hands of the user to allow the items to more easily be transferred.

To provide such features, the invention provides a dispensing unit having an enclosure with an interior for holding items. The enclosure includes both completely enclosed and non-enclosed structures, such as open shelves or

drawers. A receiver or microphone is provided on the enclosure for receiving verbal recitations identifying items to be transferred to or from the enclosure. The verbal recitations are translated into electronic signals and are stored and processed in a processor that is in communication with the receiver. The processor interprets the electronic signals and uses the signals to maintain records on items dispensed to individual patients as well as to maintain a running total of the number of items (both type and quantity) held in the enclosure. Processors capable of interpreting such signals include most personal home computers having a 486 microprocessor and having a suitable sound card and software such as a PE400 system that is commercially available from Speech System Inc., Boulder, Colorado. Optionally, the processor can be in communication with a central inventory control unit or can be networked to other computer systems in the medical facility. This allows inventory information from the dispensing unit to be transferred to the central inventory records. In this way, the inventory records of the medical facility can easily and rapidly be updated.

The enclosure of the dispensing unit will usually include a plurality of storage locations and will hold a wide assortment of different items. In such a case, the processor uses the electronic signals from the receiver to maintain records for the items in each of the storage locations. Since each of the items is often referred to by more than one name, e.g., an intravenous solution bag can also be referred to as an "IV bag", and since a wide variety of items can be held in the enclosure, the potential number of names may be too great or too varied for the software in the computer to process. In light of such problems, the invention provides an exemplary method of inputting information relating to the transfer of items by verbally reciting into the receiver at least one positional coordinate associated with each storage location. The positional coordinate uniquely defines each storage location and can include a unique symbol, e.g. a letter or a number, or can include a combination of symbols which uniquely identify an address of the storage location, e.g., row

numbers, column numbers, shelf numbers, bin numbers, and the like. Use of a positional coordinate is particularly advantages because a relatively small number of coordinates can be used to uniquely identify each of the items held in the various storage locations of the unit. For example, if the items in the unit are arranged on a shelf according to row and column, transfer of an item for one of the storage locations can be accomplished by verbally reciting in succession the row and column numbers. Since the row and column numbers are used in combination, the total number of unique symbols can be limited. Convenience is also provided to the user by ensuring that there is only one set of positional coordinates for each storage location.

Although verbal recitations are a preferred way to enter transfer related information into the processor, the dispensing unit can optionally include manual entry devices, such as a keyboard and monitor or a bar code reader. Such manual entry devices can be used as a backup system or can be used jointly with the voice receiver to provide an alternative entry system.

The invention further provides for audible feedback from the processor to confirm the verbal recitations regarding the transfer of items. For example, after the identifying information has been entered, the processor confirms the selection by reciting what it believes to be the entered identification information. Preferably, the audible feedback is a prerecorded message that is stored in the processor. Alternatively, the processor can perform a text-to-speech conversion and covert existing code stored in the computer into the audible message. If the audible feedback fails to correspond to the entered response, the user can reenter the response.

Audible feedback can also be given to confirm non-verbal requests to transfer items. Such non-verbal requests include requests entered via a keyboard or a touch-sensitive button as described in the previously referenced "see and touch" type dispensing units. After the non-verbal request has been made, the request is stored in the processor. A

signal is then sent from the processor to produce an audible message from a speaker to confirm the request. For example, a request to remove an IV bag could be selected from a keyboard. An audible confirmation would then be produced stating, "You
5 have requested to remove one IV bag."

The processor is configured to produce audible recitations requesting or prompting the user to enter appropriate information, e.g., "Please enter the number of gauze pads to be removed." Optionally, a monitor can be
10 provided for producing a visual prompt along with or separate from the audible prompt.

The invention provides security for the items held in the unit in a variety of ways. In one preferred way, the enclosure includes locking doors. Access to the items is
15 denied unless the user enters the appropriate user and patient identification information. This information can be manually entered or can alternatively be spoken into the receiver. Access can further be denied until identification information as to an item to be transferred is verbally recited. In one
20 particular aspect, the voice of the user spoken into the receiver is compared to a voice sample of the user when accessing the dispensing unit. If the processor determines that the voice of the user differs from the voice sample, access to the items will be denied.

Further security for the items can be provided by audibly announcing when the dispensing unit has been accessed without a request to transfer an item. The audible message is intended to remind the user that a request has not yet been entered in an attempt to encourage the user to first record a
30 desired transfer before actually transferring the item. To produce such a message, the dispensing unit can be provided with a sensor for determining when its enclosure has been accessed. Usually, the sensor will include an electronic, a magnetic, or a light sensor for sensing when a door or a
35 drawer of the unit has been opened. The sensor is in communication with the processor so that when actuated a signal is sent to the processor indicating access to the unit. The processor can then search its memory to determine if a

transfer request has been entered, either verbally, by keyboard, or by see and touch. If not, a signal is sent to a speaker to produce an audible message reminding the user that a transfer request has not yet been entered. Optionally, the processor can record when access to the unit has been made and a request to transfer not entered.

The processor is provided with a record containing an inventory of both the type and quantity of the items held as well their storage locations in the enclosure. This record is stored within the processor's memory. Alternatively, the processor can be networked to other computer systems in the medical facility so that inventory information can rapidly be accessed. After identification information as to the type and quantity of an item to be transferred has been verbally recited into the receiver, the processor adds or subtracts the items to be transferred from the stored record. In this way, a running total of both the type and quantity of the items held in the unit can be maintained. To restock the unit, the depleted items are replaced and the number of new items added is entered into the processor. After each storage location has been restocked and recorded, the processor can produce an audible message confirming the number of items placed therein. This helps to insure that the number of items entered and the number of items actually placed in the storage location are the same.

On occasion, the number of items held in the storage locations may not correspond to the record maintained by the processor. This can happen, for example, if the user verbally recited a different number of items than were actually removed. To account for such discrepancies, the processor can be configured to periodically produce an audible request during the restocking procedure requesting entry of the actual number of items held in a particular storage location. The response can be either verbally or manually entered into the processor. The response is then processed and compared to the stored record to see if they are in agreement. A report can then be generated reporting the comparison. This report can

be used to remind the users to enter the correct information or can signal to management that further training is required.

Referring to the drawings, an exemplary dispensing unit 10 is shown in Fig. 1. The dispensing unit 10 includes an enclosure 12 and a plurality of adjustable shelves 14. Each shelf 14 can be subdivided to form a plurality of storage locations 18. Disposed on the shelves 14 and near each storage location 18 are a plurality of visual indicators 20. The visual indicators 20 are used to assist in locating an item to be removed from the dispensing unit 10 once item identification information has been entered.

A processor 22 is provided on one of the shelves 14. Alternatively, the processor can be located separate from the enclosure 12. The processor 22 contains a list of all of the items (both type and quantity) held in the dispensing unit 10 and their respective storage locations 18. The processor 22 updates this list as items are transferred to or from the unit 10. The processor 22 further includes a patient list and is able to record the type and quantity of items transferred to or returned from each patient. Upon request, the processor 22 can generate a list of items distributed to each patient so that accurate billing records can be maintained.

A receiver 24 is in communication with the processor 22 and is used to receive verbal recitations from the user. The receiver 24 is shown as a microphone connected to the processor by a cord 26. In this way, the user can carry the receiver when attempting to locate the items. Alternatively, the receiver 24 can be removably attached or built into the processor 22 or the enclosure 12 so that the user's hands can remain free while selecting items. As the user speaks into the receiver 24, the verbal recitations are converted to electronic signals and sent to the processor 22. For return communication, the processor 22 includes a speaker 28. Through the speaker 28, the processor 22 can request information to be entered or can confirm a response or selection. Alternatively, communication with the processor 22 can be accomplished by a keypad 30 and a screen 32.

The dispensing unit further includes a plurality of doors 34 which can be used to provide security for the items held in the unit 10. The doors 34 are preferably transparent and can be locked to prevent access to the items in the unit until appropriate identification information has been entered. When such information has been entered, the processor 22 sends a signal to unlock the doors 34 and allow access to the items.

Referring to Fig. 2, the transfer of items to or from the storage locations 18 will be described in greater detail. Each shelf 14 is preferably provided with a different row number R, and each storage location 18 is provided with a bin number B. These two numbers are used as positional coordinates to define each storage location 18. For instance, the coordinates (1,1) define the first bin on the first shelf. To transfer an item to or from this storage location the user speaks the request "one" "one" into the receiver 24. The processor 22 is able to translate this request into a request to transfer an item to or from the first bin on the first shelf. This information is then used by the processor 22 to update the record as to the number of items held in this location. After the verbal request is made, the visual indicator 20 adjacent the requested storage location 18 is lighted to assist the user in locating the correct storage location.

As shown in Fig. 3, the storage locations 18 can also be located in a drawer 36. Other devices for holding the storage locations 18 include racks, pegs, and the like. The drawer includes a drawer number D that is different from the shelf numbers. Each of the storage locations 18 in the drawer 36 are numbered. In this way, a two dimensional coordinate can be spoken to identify the storage location in the drawer 36 having the item to be transferred.

Referring to Fig. 4, an exemplary method for transferring items to or from a dispensing unit of the type previously recited in Fig. 1 will be described. Initially, the processor requests entry of user and patient identification information. This prompt can be a visual prompt, a verbal message, or both as previously described.

The user and patient identification information are then entered into the processor, either verbally or manually. Another prompt is then given requesting whether an item is to be taken or returned. The user then speaks into the receiver whether an item is to be taken or returned. Preferably, this is accomplished by speaking either the word "take" or the word "return". The processor then requests the positional coordinates of the storage location having the item. The appropriate coordinates can easily be determined by visually locating the target storage location through the transparent doors and noting the associated positional coordinates. The positional coordinates of the target storage location are then spoken in succession, e.g., "one" "four". A verbal message is then recited by the processor confirming the selection. The verbal message can include the positional coordinates as recited, the name of the desired item, or both. In addition to speaking the positional coordinates into the receiver, the name of the item can alternatively be spoken into the receiver. The recited name can then be compared to the positional coordinates to confirm the selection. If the recited name and the coordinates do not match, the user can be prompted to reenter the selection.

After the item has been selected, the processor prompts the user for the desired quantity to be taken or returned. The response can be verbally entered by speaking the desired number, e.g., "two". This selection is then verbally confirmed by the processor to insure the intended response was understood and recorded.

The processor then inquires whether another item is to be transferred. The response can be verbally entered into the receiver by speaking "yes" or "no". If the response is "yes", the processor then requests whether the item is to be taken or returned and the previously described method is repeated. If the response is "no", the user verbally recites that he or she is ready to transfer the items. This is preferably accomplished by speaking the words "take items" or "return items". The door of the unit then unlocks and the desired items are taken or returned. To assist in locating

the items, the visual indicator by the target locations are lighted when the positional coordinates are spoken into the receiver.

Once the door is opened, the transfer information is recorded in the processor. Any items removed are added to the patient's bill, and any items returns are subtracted from the bill. The processor further keeps a running total of the items held in each storage location by adding or subtracting the items to or from the record of items stored in the computer. For instance, in the above examples, if "take" was spoken, the patient would be billed for two items from storage location (1, 4), and the record of the total items held in the storage location (1, 4) would have two items subtracted.

When all the items are transferred the user closes the doors which lock upon closing. The user is then prompted as to whether another transaction is desired for the same patient. The response can be entered by speaking "yes" or "no". If the response is yes, the previously described processes can be repeated by speaking "take" or "return". A further prompt is given by the processor requesting whether another transaction is desired for a different patient. The response can be entered by speaking "yes" or "no". If the response is yes, the processes can be repeated by entering the new patient's identification information into the processor.

Referring to Fig. 5, an exemplary method for restocking items into the dispensing unit 10 of Fig. 1 is shown. Initially, user identification information is entered by the user and the unit is placed in the restock mode by selecting a restock option on the processor. The user can then restock the items in the desired storage locations and enter their placement into the processor. The processor then produces a verbal message reciting the entered response to confirm the number of items placed in the storage locations. For example, the processor could produce a verbal message reciting, "You are restocking seven 10cc syringes into storage location two, four." If the verbal confirmation is incorrect, the information can be reentered into the processor. Optionally, the processor can further verbally inquire as to

the actual number of items held in the storage locations. To respond, the user counts the actual items in the storage location and enter this number into the processor. The processor compares this entry with the running total that is
5 calculated from previous user entries when transferring items. A report can then be generated showing the comparison and reporting any discrepancies.

The invention has been described in considerable detail for purposes of understanding. However, alternative
10 embodiment of the invention will occur to those skilled in the art. Therefore, the above description should not be taken as limiting the scope of the invention. Instead, the scope of the invention should be determined chiefly with reference to the appended claims, along with the full scope of equivalence
15 to which those claims are entitled.

WHAT IS CLAIMED IS:

1 1. A method for recording inventory information
2 related to addition and removal of items to or from a target
3 storage location in an enclosure having a plurality of storage
4 locations each or which has at least one positional coordinate
5 which is visually apparent, the method comprising:

6 visually locating the target storage location in the
7 enclosure and determining its positional coordinate;

8 verbally reciting the positional coordinate
9 associated with the target storage location;

10 translating the verbally recited positional
11 coordinate into an electronic record; and

12 transferring a desired item to or from the target
13 storage location.

1 2. The method of claim 1, wherein the positional
2 coordinate is recited to a receiver on the enclosure in
3 communication with a processor to record the transfer, further
4 comprising producing an audible message which confirms the
5 electronic record, and wherein the audible message is a
1 prerecorded message stored in the processor or is produced
2 from the processor based on code stored in the processor.

1 3. The method of claim 1, further comprising
2 producing a visual signal on the enclosure near the storage
3 location of the item in response to the verbally recited
4 positional coordinate, and further comprising determining a
5 second positional coordinate associated with the target
6 location and verbally reciting the second positional
7 coordinate.

1 4. The method of claim 1, further comprising
2 verbally reciting the name of the item to be transferred and
3 comparing the positional coordinate and the name to confirm
4 that the positional coordinate was correct, and further
5 comprising verbally reciting whether the item is to be taken
6 or returned prior to transferring the item.

1 5. The method of claim 2, further comprising
2 providing patient and user identification information to the
3 processor prior to transferring the desired item, further
4 comprising preventing access to the enclosure until patient
5 and user identification information have been entered into the
6 processor, further comprising verbally reciting into the
7 receiver the quantity of items to be transferred, and further
1 comprising producing an audible message which confirms the
2 quantity selected.

1 6. The method of claim 2, further comprising
2 preventing access to the enclosure until the positional
3 coordinate has been verbally recited to the receiver, further
4 comprising comparing the voice of the user spoken into the
5 receiver with a voice sample of the user, and preventing
6 access to the enclosure if the voice of the user differs from
7 the voice sample.

1 7. A method for transferring items to or from a
2 dispensing unit having an enclosure with an interior for
3 holding items, the method comprising:
4 visually locating a desired item in the enclosure;
5 verbally reciting information identifying the item
6 to be transferred;
7 translating the verbal information into an
8 electronic signal;
9 transferring the item to or from the enclosure; and
10 recording the signal to produce a running total of
11 items present in the enclosure.

1 8. An improved method for recording inventory
2 information related to addition and removal of items to or
3 from a target storage location in an enclosure having a
4 plurality of storage locations and an associated processor for
5 storing electronic information as to the type and quantity of
6 items in the enclosure, wherein the improvement comprises
7 providing information as to type and quantity of items to the
8 processor verbally as items are transferred.

1 9. The method of claim 8, further comprising
2 translating the verbal information into an electronic signal
3 and recording the signal in the processor to produce a running
4 total of items present in the enclosure, and wherein the
5 running total is produced by adding or subtracting the
6 recorded signal to or from the electronic information.

1 10. A method for confirming a non-verbal selection
2 of an item to be transferred to or from a dispensing unit
3 having an enclosure with an interior for holding items, said
4 method comprising:

5 non-verbally selecting an item to be transferred to
6 or from the dispensing unit;

7 recording the selection in a processor on the
8 dispensing unit; and

9 sending a signal from the processor to a speaker
10 associated with the dispensing unit to produce an audible
11 message confirming the selection.

1 11. A method for producing an audible alarm when an
2 enclosure of a dispensing unit has been accessed, said method
3 comprising:

4 sensing when the enclosure has been accessed;

5 sending a signal to a processor on the dispensing
6 unit indicating the access to the enclosure;

7 sensing whether the transfer of an item to or from
8 the enclosure has been requested prior to or during the
9 access; and

10 producing an audible message stating that a
11 transaction has not been requested if a requested transfer of
12 an item has not been sensed.

1 12. A dispensing unit, comprising:

2 an enclosure having an interior for holding items;

3 a receiver for receiving verbal recitations

4 identifying items to be transferred to or from the enclosure;

5 a processor in communication with the receiver,

6 wherein the processor interprets the verbal recitations from

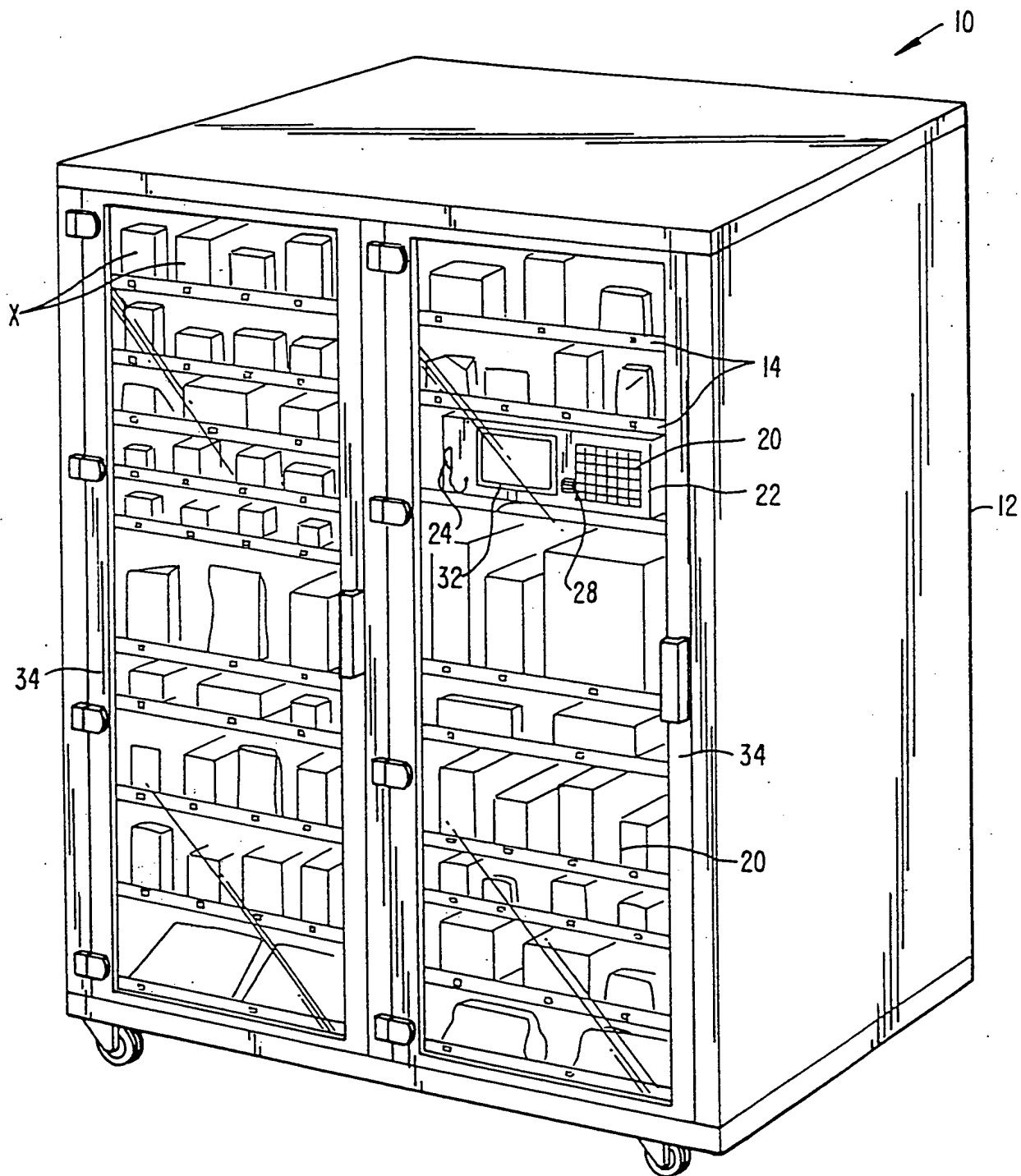
7 the receiver and maintains records on items dispensed to
8 individual patients and on total number of items in the
9 enclosure.

1 13. The dispensing unit of claim 12, wherein the
2 enclosure further includes a plurality of storage locations,
3 wherein the processor maintains records on each location,
4 wherein the processor interprets verbally recited positional
5 coordinates relating to each storage location, and wherein
6 each storage location has at least two positional coordinates
7 and wherein the processor interprets the two coordinates which
8 are successively recited.

1 14. The dispensing unit of claim 13, wherein at
2 least some of the storage locations include shelves or drawers
3 having bins, wherein the first coordinate defines the shelf or
4 drawer and the second coordinate defines the bin on that shelf
5 or drawer, and further comprising means for audibly confirming
6 the transfer of an item.

1 15. The dispensing unit of claim 13, wherein the
2 enclosure includes a door for allowing access into the
3 interior of the enclosure and means for locking the door to
4 prevent access to the interior, wherein the door is unlocked
5 by a signal sent from the processor after user and patient
6 identification information have been entered into the
7 processor and one of the positional coordinates has been
8 spoken into the receiver and after the quantity of the item to
9 be transferred has been spoken into the receiver, and further
10 comprising means for determining whether user identification
11 information corresponds to the voice of the user.

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*FIG. 1.*

SUBSTITUTE SHEET (RULE 26)

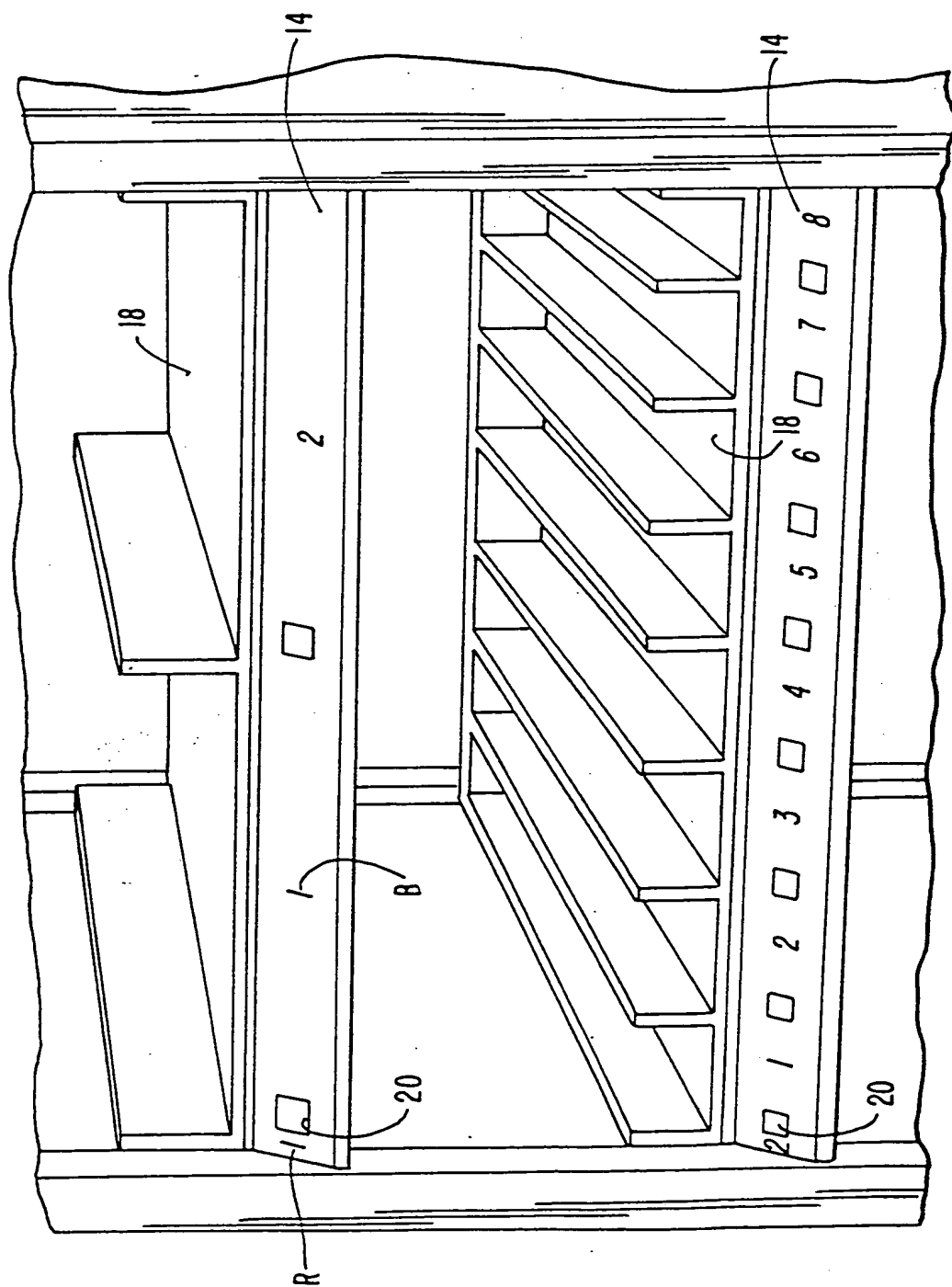


FIG. 2.

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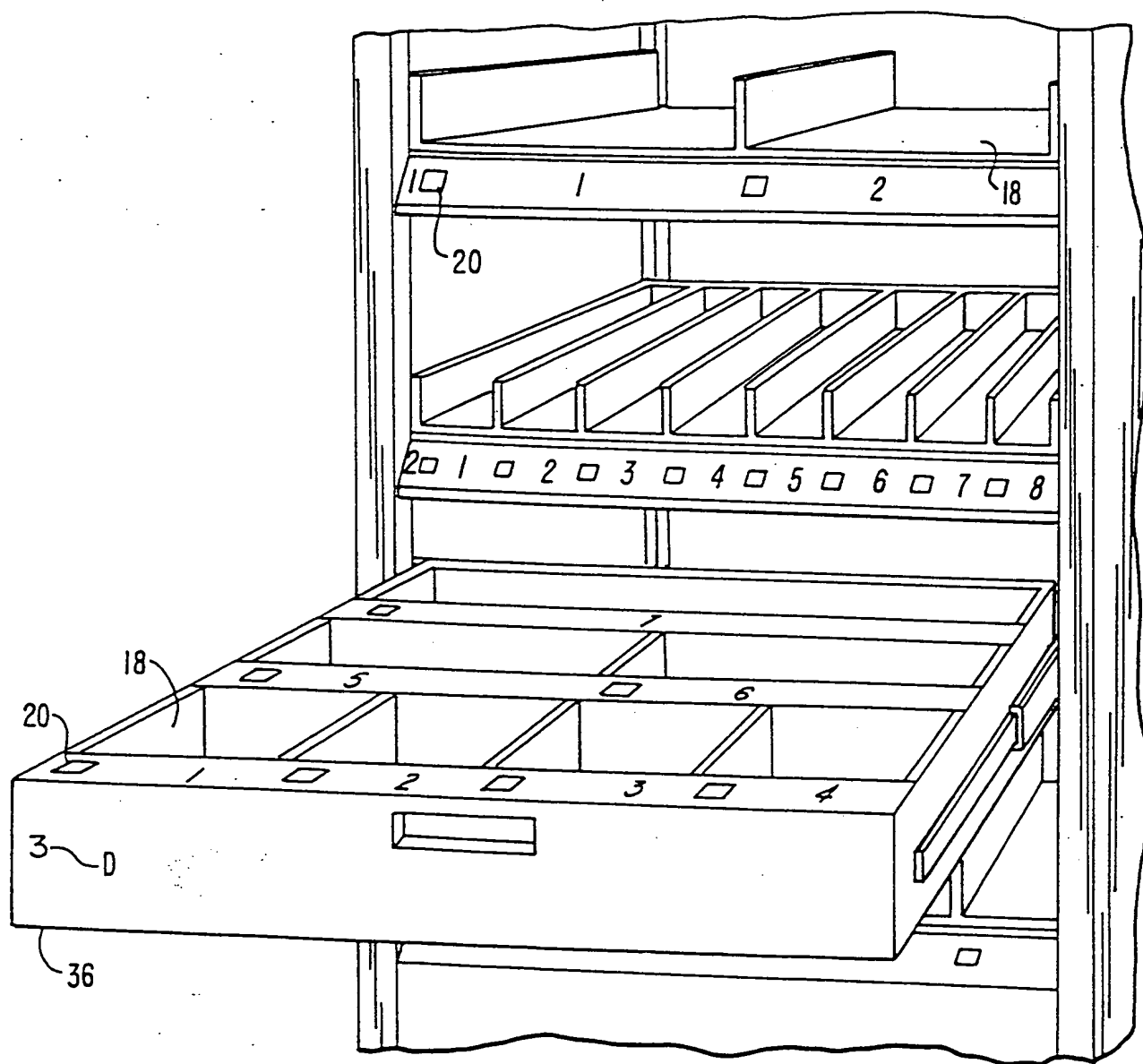


FIG. 3.

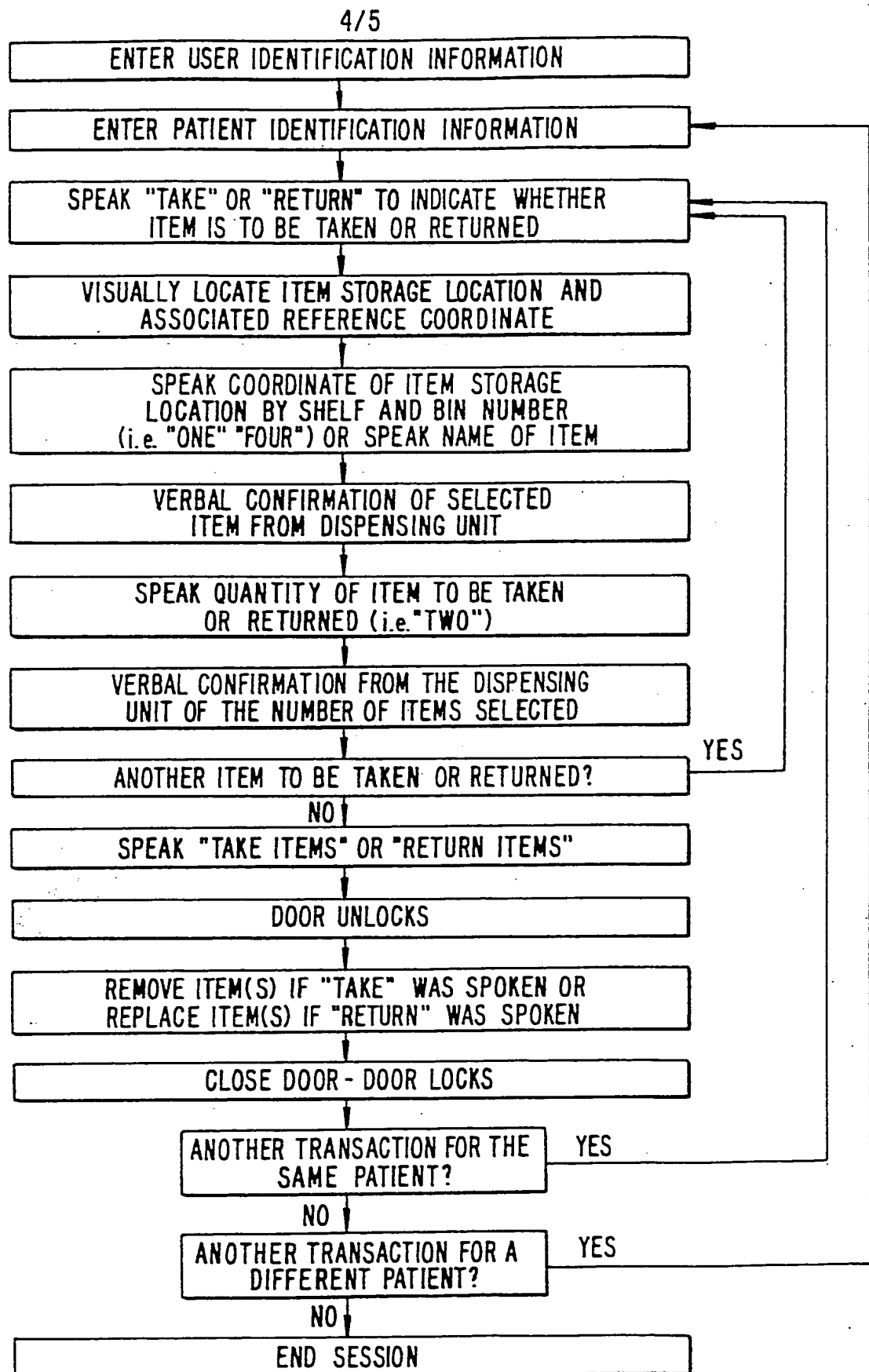


FIG. 4

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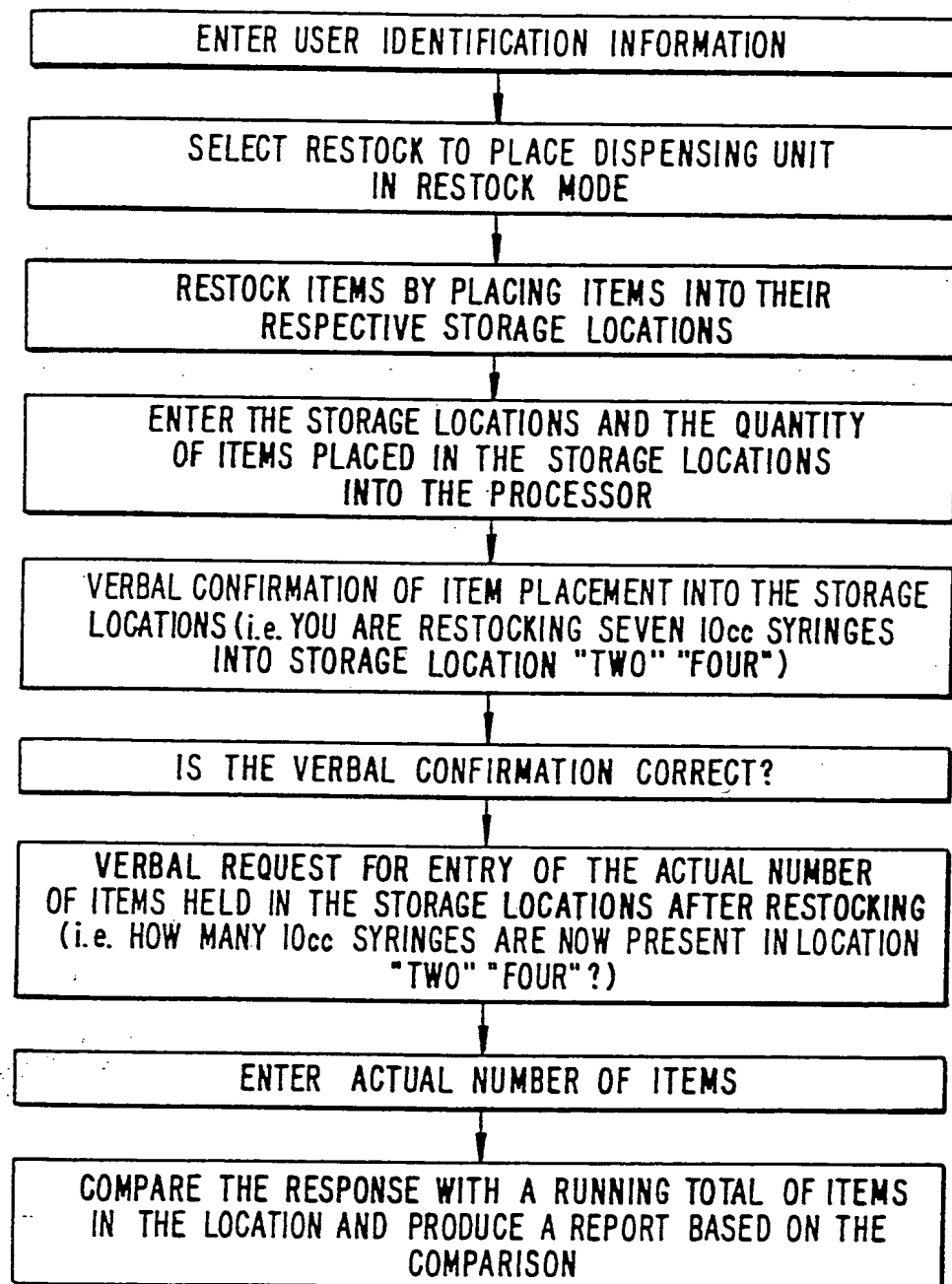


FIG. 5.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US95/17047

A. CLASSIFICATION OF SUBJECT MATTER

IPC(6) :G10L 3/00; G06F 159:00

US CL :395/2.84; 364/479

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 395/2.55, 2.79, 2.82, 2.84; 364/479

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

APS: Articles, Dispense, Vend, coordinate, select, display, audible, speech, voice, inventory

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US, A, 4,231,105 (SCHULLER ET AL) 28 October 1980, cols. 1-4, fig. 1.	1-4
Y	US, A, 4,354,613 (DESAI ET AL) 19 October 1982, figure 1, abstract, col. 2, 4, 12, 13.	1
Y	US, A, 4,896,024 (MORELLO ET AL) 23 January 1990, col. 13, 14, figure 1, abstract.	1-7
Y	US, A, 4,776,016 (HANSEN) 04 October 1988, figure 3, abstract, figure 3, col. 4-5.	1-7
Y	US, A, 5,265,191 (MCNAIR) 23 November 1993, abstract.	6
Y, P	US, A, 5,468,110 (MCDONALD ET AL) 21 November 1995, figure 6, abstract.	1 and 7

☒ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

A	Special categories of cited documents: document defining the general state of the art which is not considered to be part of particular relevance	*T*	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
E	earlier document published on or after the international filing date	*X*	document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
L	document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	*Y*	document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
O	document referring to an oral disclosure, use, exhibition or other means	*G*	document member of the same patent family
P	document published prior to the international filing date but later than the priority date claimed		

Date of the actual completion of the international search

23 MAY 1996

Date of mailing of the international search report

13 JUN 1996

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/US95/17047

Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This international report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

Please See Extra Sheet.

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:
1-7

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
☐ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US95/17047

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US, A, 4,839,505 (BRADT ET AL) 13 June 1989, abstract, columns 2-3, 7 and 34.	1, 6 and 7
A	US, A, 4,847,764 (HALVORSON) 11 July 1989, figures 1 and 2, abstract.	1, 5 and 7.
Y	US, A, 4,933,873 (KAUFMAN ET AL) 12 June 1990, figures 1-10, abstract.	1-7

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US95/17047

BOX II. OBSERVATIONS WHERE UNITY OF INVENTION WAS LACKING

This ISA found multiple inventions as follows:

This application contains claims directed to more than one species of the generic invention. These species are deemed to lack Unity of Invention because they are not so linked as to form a single inventive concept under PCT Rule 13.1. In order for more than one species to be examined, the appropriate additional examination fees must be paid. The species are as follows:

- I. Claims 1-7 directed towards speech controlled systems (395/2.84);
- II. Claims 8 and 9 directed towards the business practice of taking inventory (364/401);
- III. Claims 10 and 11 directed towards article dispensing (364/479) having a spoken warning or alarm (395/2.83); and
- IV. Claims 12-15 directed towards speech controlled systems (395/2.84) with patient monitoring (364/413.02).

The species listed above do not relate to a single inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, the species lack the same or corresponding special technical features for the following reasons: as listed above, the claimed inventions contain diverent subject matter and have been recognized in the prior art as having separate industrial applicability.